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Indian Standard

AUTOMOTIVE VEHICLES — SHOCK ABSORBERS — SPECIFICATION

(Second Revision)

भारतीय मानक

स्वचल वाहन — प्रघात अवशोषक — विशिष्टि

(दूसरा पुनरीक्षण)

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AMENDMENT NO. 2 NOVEMBER 1995
TO
IS 5423 : 1989 AUTOMOTIVE VEHICLES — SHOCK ABSORBERS — SPECIFICATION

(Second Revision)

[*Page* 3, *clause* 7.2(d), *first sentence*] — Substitute the following for the existing:

'Damping force shall be the average of the value recorded between the sixth and the tenth stroke. They will be the peak values the forces developed during the stroke of the shock absorber normally occurring at the middle of the stroke.'

[*Page* 4, *clause* 7.3(e)] — Substitute the follo ing for the existing:

'e) Shock absorber shall be mounted on the dyna ic testing machine with the flexible end mounting. The maximum permi ible deflection of the shock absorber axis in vertical plane when mounted in the endurance test fixture should not exceed the values specified in 6.6.2

[*Page* 4, *clause* 7.3(f)] — Add the following te at the end of the clause:

'NOTE — The testing may be carried out either contin ously or intermittently.'

(TED 5)

Reprography Unit, BIS, New Delhi, India

Indian Standard

AUTOMOTIVE VEHICLES — SHOCK ABSORBERS — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers the requirements for hydraulic telescopic shock absorbers and gas charged hydraulic shock absorbers used in automotive suspension

2 REFERENCE

2.1 The Indian Standard IS 12648 : 1989 'Automotive vechicles — Shock Absorbers — End Mountings — Dimensions and tests' is a necessary adjunct to this standard

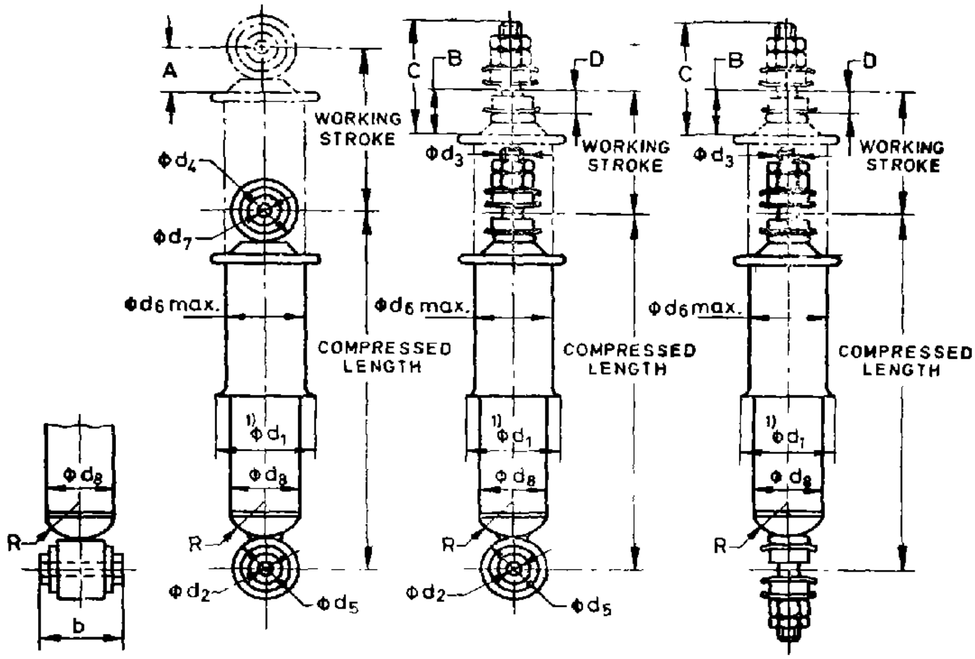
3 TERMINOLOGY

3.1 Bore

The inside diameter of main working cylinder of the shock absorber.

3.2 Compressed Length

Length between the mounting eyes (centre to centre distance), or mounting faces (in case of studs), or mounting eye and mounting face (in case of eye and stud) of a shock absorber when it is compressed to the maximum (*see* Fig. 1).



MOUNTING EYE AT EITHER END

MOUNTING EYE AND MOUNTING STUD

MOUNTING STUD AT EITHER END

1) OPTION TO INDICATE

FIG. 1 DIMENSIONS FOR SHOCK ABSORBERS

Automotive Vehicles Suspension and Steering System Sectional Committee, EDC 105

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards on 4 March 1989, after the draft finalized by the Automotive Vehicles Suspension and Steering Systems Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard was originally published in 1969 and the first revision was published in 1978. This second revision of the standard has been published incorporating the requirements of gas charged hydraulic shock absorbers also.

3.3 Compression Stage

A stage in which the mountings of shock absorbers approach each other.

3.4 Damping Characteristics

For any type of hydraulic unit, it shall mean the damping force at corresponding maximum plunger velocity defined in **3.11**

3.5 Dead Length

Length constituted by the built-in components of shock absorber when the stroke is zero (*see* **3.13**).

3.6 Double Acting Shock Absorbers

Shock absorbers which damp the oscillations of a vehicle suspension in both the directions, damping action being different or equal in either direction depending on the individual application requirements

3.7 Extended Length

Length between the mounting eyes (centre to centre distance), or mounting faces (in case of studs), or mounting eye and mounting face (in case of eye and stud) of a shock absorber when it is pulled out to the maximum (*see* Fig 1)

3.8 Extension Stage

A stage in which the mountings of shock absorbers move away from each other.

3.9 Fitment Dimensions

All the dimensions required for mounting the shock absorber on the vehicle (*see* dimensions *A*, *B*, *C* and *D* in Fig. 1).

3.10 Gas Charged Hydraulic Shock Absorbers

Telescopic hydraulic shock absorbers in which, in addition to oil, gas is charged at pressure

3.11 Maximum Plunger Velocity

Subsequently referred to as 'velocity' shall be defined by the expression, V_{Max} :

$$V_{Max} = \pi \times n \times s$$

where

V_{Max} = maximum plunger velocity, mm/s;

n = machine revolution, cycles per second; and

s = stroke, mm.

3.12 Restitution Force

The resultant force acting on the plunger rod due to the gas pressure and is given by the equation:

Restitution force = gas pressure × rod sectional area

3.13 Stroke

The difference between the extended length and the compressed length (effective maximum travel of the shock absorber) (*see* Fig. 1).

4 DIMENSIONS AND TOLERANCES

4.1 Dimensions shall be according to the application of the shock absorber The dimensions given in Fig. 1 shall be specified in the enquiry or order The tolerances for compressed and extended lengths shall be ±3 mm.

4.2 Shock absorbers shall be designated by the cylinder bore.

5 METHOD OF SPECIFYING THE SHOCK ABSORBER

5.1 For the purposes of enquiry or order relating to shock absorbers, the following information shall be supplied:

a) Dimensions as indicated in Fig. 1,

b) Make and model of the vehicle;

c) Whether used at the front wheels or rear wheels, and the type and the rating of the spring; maximum bump load, weight of the vehicle in laden and unladen conditions, and the inclination of mounting the shock absorbers;

d) A graph showing the load characteristics in Newton for compression and extension at specified plunger velocity (as defined at **3.11**) and optionally load values at various plunger velocities may be given for reference, and

e) Any other information relevant to the design of the shock absorber.

6 GENERAL REQUIREMENTS

6.1 Strength of the end mounting weld shall be as specified in IS 12648 : 1989. A pull out test shall be conducted for weld soundness The method of test and acceptance values shall be mutually agreed to between the purchaser and the manufacturer As a guideline, the shock absorbers shall be gripped in a suitable fixture to produce a straight tensile pull between the end eye or the stem and its fixing shall withstand the following loads:

Category (in terms of internal diameter of cylinder)	*Loads*
Less than 24 mm	6 860 N
24 mm but less than 29 mm	14 700 N
29 mm but less than 34 mm	17 640 N
34 mm but less than 39 mm	29 400 N
39 mm but less than 49 mm	34 300 N

6.2 The shock absorbers shall be assembled in such a manner that the movement shall be uniform throughout the stroke. For this purpose, the shock absorbers shall be manually primed three or four times in a vertical position. This is only indicative of the uniformity of the operation.

6.3 The upper part of the shock absorber, that is, plunger rod and dust cover sub-assembly shall be capable of free rotation relative to the lower part, namely, cylinder and outer tube sub-assembly.

6.4 Effective clearance between dust cover and outer tube shall be maintained throughout the full stroke of the shock absorber to preclude the possibility of rubbing.

6.5 If the shock absorber assembly is provided with rebound and/or compression stop, the buffers shall not produce objectionable ride or noise effects

6.6 End Mountings

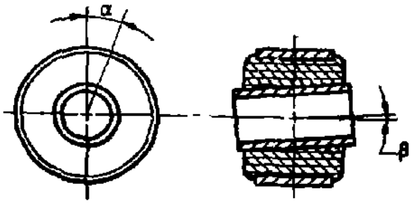
6.6.1 Shall be as shown in Fig 2

6.6.2 The end mountings may be either eye ring type or stud type as agreed between the manufacturer and the user If the angular motions in different surfaces are almost equal, a stud type mounting is recommended The maximum permissible deflections as shown in Fig 2 shall be as follows:

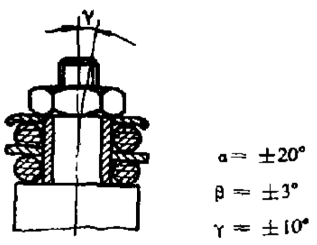
$\alpha = \pm 20°$

$\beta = \pm 3°$

$\gamma = \pm 10°$



EYE MOUNTING



STUD MOUNTING

FIG. 2 END MOUNTING OF SHOCK ABSORBERS

6.6.3 For better performance of the shock absorbers, these shall be installed as close to vertical as possible (not to exceed by 45° even *during* operations).

7 TESTS

7.1 Tests outlined in this standard shall be carried out on the shock absorber (*without the suspension spring*), that is on the damper unit only.

7.2 Damping Force Test

It is required for ascertaining the force-piston velocity characteristics of shock absorber and shall be carried out as follows :

a) Each shock absorber shall, where necessary, be actuated prior to testing to ensure that the working chamber is free from any air pocket;

b) Shock absorber shall be tested along its own axis, that is, the damper axis parallel to the stroke of the dynamic testing machine;

c) Shock absorbers shall be mounted on the dynamic testing machine with or without flexible end mountings as agreed to between the manufacturer and the purchaser. The dynamic testing machine shall be rigid and the vertical slide properly guided;

d) Damping force shall be recorded between the sixth and the tenth stroke. They will be the peak values of the forces developed during the stroke of the shock absorber normally occurring at the middle of the stroke;

e) Test specification shall be only at one maximum plunger velocity;

Table 1 Tolerances on Initial Damping Resistances

[*Clause* 7.2 (*f*)]

Damping Force	Tolerance on	
	Compression Force	Tension Force
N	N	N
100	± 40	± 40
200	± 50	± 45
300	± 60	± 50
400	± 70	± 60
500	± 80	± 65
600	± 90	± 75
700	± 95	± 80
800	± 100	± 85
900	± 105	± 95
1 000	± 110	± 10 percent
1 100	± 115	± 10 percent
1 200	± 10 percent	± 10 percent

NOTES

1 At lower resistance values, percentage tolerance is higher.

2 For damping resistance (tension) above 1 000 N, tolerance shall be ±10 percent.

3 For damping resistance (compression) above 1 200 N, tolerance shall be ±10 percent.

f) The tolerences on the damping resistance shall be according to Table 1, unless otherwise agreed to between the manufacturer and the user;

g) The load/displacement curve shall show no evidence of erratic control pattern which indicates that this assembly, binding or foreign material is preventing proper functioning of the valves;

h) Effect of temperature as given in 8 shall be applicable, wherever necessary;

j) The damping resistance of gas-charged shock absorbers will be checked in the following manner:

1) The shock absorbers will be stroked in the centre of the stroke and the damping values at the mid-point of the stroke shall be noted.

2) The resistance will be indicated or recorded on the dynamic testing machine.

3) The restitution force at the mid-point of the stroke will be recorded by a suitable measuring device.

4) The observed values will be corrected as follows to get the true damping resistance.

Damping resistance in tension = observed value + restitution force

Damping resistance in compression = observed value − restitution force

7.3 Endurance Test

It is a type test applicable for shock absorbers having a resistance of 200 N or more. When tension or compression force is more than 200 N at the specified maximum plunger velocity, this test shall be carried out for that particular force. It shall be carried out as follows :

a) The test shock absorber selected shall be mounted on the dynamics testing machine and the initial damping resistances in tension and compression shall be recorded.

b) Shock absorber whose initial damping resistances have been measured [*see* **7.3** (a)] shall be mounted on the endurance testing machine. Testing speed shall be 60 to 100 cycles per month. Test shall be conducted at 75 percent of the working stroke of the shock absorber or 100 mm whichever is less.

c) In case endurance test is to be conducted under more rigorous conditions including the side load, appropriate test configurations and test cycles shall be as agreed between the manufacturer and the user

d) During the test, temperature shall be controlled between 70 and 90°C which should be measured on the outer tube (reservoir) of the shock absorbers. In the case of low resistance shock absorber where the temperature does not rise up to 70°C due to less energy absorption, testing shall be conducted at the temperature attainable without external cooling

NOTE — The method of cooling during the endurance test is optional but shall be such that any leakage of shock absorber fluid can be easily seen during the endurance test.

e) Shock absorbers shall be mounted on the dynamic testing machine with flexible end mountings.

f) Test shall be conducted for one million cycles. At the end of the test, no leakage or breakage shall be noticeable After the end of one million cycles operation, the shock absorber shall be subjected to the damping force test as indicated in **7.2**. Variation in resistance shall not exceed the values indicated in Table 2 from the initial damping resistance [*see* **7.3** (a)]

Table 2 Permissible Variation in Damping Resistance After One Million Cycle Endurance Tests from Original Values Observed

[*Clause* 7.3 (f)]

Damping Resistance N	Tension	Compression
100 to 200	+ 40 N − 60 N	+ 40 N − 60 N
201 to 500	+ 20 % − 30 %	+ 20 % − 30 %
501 to 1 500	+ 15 % − 20 %	+ 15 % − 25 %
1 501 and above	+ 10 % − 10 %	+ 10 % − 10 %

g) All components of sock absorbers including pins, bushes, eye welding, etc, shall withstand one million cycles endurance test.

h) Recheck the unit after standing fully collapsed and inverted for 24 hours. Leakage (continuous dripping) shall not be observed

8 EFFECT OF TEMPERATURE ON DAMPING CHARACTERISTICS

8.1 Temperature correction shall not be applied if the test room temperature is within the range of 16 to 35°C.

8.2 At test room temperature between 10 to 50°C, shock absorber characteristics shall be permitted to exceed the tolerances stipulated in **7.2** (f) by not more than an additional 0·5 percent for each 2° change in temperature below or above the basic temperature of 16 to 35°C. Correction of damping characteristics in excess of 50°C or less

AMENDMENT NO. 1 NOVEMBER 1990
TO
IS 5423:1989 AUTOMOTIVE VEHICLES - SHOCK ABSORBERS - SPECIFICATION

(Second Revision)

[Page 4, clause 7.3 (b), line 4] - Substitute *the following for the existing sentence:*

'Testing speed shall be 60 to 100 cycles per minute.'

(TED 5)

Reprography Unit, BIS, New Delhi, India

than 10°C shall be subjected to agreement between the purchaser and the manufacturer.

9 INSPECTION

9.1 The finish shall be as agreed to between the purchaser and the manufacturer.

9.2 The damping force shall be tested according to **7.2**.

9.3 The visual inspection shall reveal that the shock absorbers are free from cracks, burrs, sharp edges, unpainted areas and other defects which may impair their assembly or performance.

9.4 No visual evidence of any oil leakage shall be present on any external surface of the shock absorbers when tested as follows:

a) Check unit after stroking for 10 to 15 full strokes.

b) Recheck unit after standing fully collapsed and inverted for 24 h.

10 MARKING

10.1 The shock absorbers shall be marked with the following:

a) Manufacturer's name or trade-mark and part number or vehicle manufacturer's reference number,

b) Date of manufacture in code or month and year of manufacture on the shock absorber, and

c) Month and year of manufacture on the carton containing the shock absorber

11 PACKING

11.1 Shock absorbers shall be packed in suitable cartons or as agreed between the manufacturer and the purchaser.

12 SAMPLING

12.1 Lot

All the shock absorbers of the same type manufactured in a factory from the same material under similar conditions of production shall be grouped together to constitute a lot.

12.2 The sampling plan shall be as agreed between the manufacturer and the user.

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